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(54) PLASMA-ETCHING METHOD FOR OXIDE

(57)Abstract:

PURPOSE: To provide a plasma-etching method for oxide, having high selectivity with respect to nitride, including nitride formed on the sidewall of step on an IC structure.

CONSTITUTION: In a plasma-etching method for etching an oxide in the presence of nitride, when one or more hydrogen-containing gas or preferably, one or more fluoro-hydrocarbon gas is added to the etching gas of hydrocarbon, which is replaced with one or more fluorine and scavenger for fluorine, a high selectivity with respect to nitride is obtained, independent of the shape of nitride part of a substrate surface. In a preferred embodiment, one or more oxygen-carrying gas is added on a chamber surface and a surface to be etched for reducing polymer deposition rate. Preferably, the fluorine scavenger is an electrode which is related to plasma and is electrically grounded.

LEGAL STATUS

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decision of rejection]
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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the oxide etching approach of having high selectivity to the nitride which can be especially used for the front face of the configuration which is not flat, about the oxide etching approach which has high selectivity to a nitride.
[0002]
[Description of the Prior Art] The important technical problem in semi-conductor manufacture is etching oxide like silicon oxide, maintaining high selectivity at the bottom of existence of a nitride like a silicon nitride to a nitride without etching the nitride. This example is that the oxide which should be etched is arranged on a nitride. Since oxide and a nitride ingredient are generally etched at the same rate in the chemical etching plasma of the typical fluorocarbon usually used in order to etch oxide, the method of giving additional selectivity must be found out. C three F8 It is passivation coating (passivating coating) of the carbon-fluorine polymer formed on the ingredient etched by the front face of the oxide which the fluorination carbon radical reacted in the plasma when the hydrocarbon permuted with the fluorine [like] was used as etchant (charge of etching material), for example, was exposed on the substrate, and a nitride. It forms. Therefore, since oxide, for example, silicon oxide, continues etching, a nitride part is etched into a passivation coating **** sake at a very late rate on it. However, it is attacked with the free fluorine atom which has a passivation layer in the plasma, and a nitride continues being etched. Therefore, about 8:1 or more selectivity of a silicon nitride and a silicon oxide cannot be attained by the etching approach of the conventional technique because of the existence of such a free fluorine atom in the plasma. For the equipment which has submicron magnitude, i.e., VLSI and ULSI equipment, the approach of etching is required very much in oxide more nearly rather than the nitride which has 10:1 or more selectivity since thing selectivity is required even for 10:1 or more and 30:1.
[0003] Although the United States patent application number 07/No. 941,501 is related with a scavenger for fluorines like the source of silicon or carbon, if it is used with the etching gas of the hydrocarbon by which the scavenger for fluorines was permuted with the fluorine, the scavenger for these fluorines will form the abundant polymers of the carbon which is not separated on a nitride by either of the fluorine contents to which it decreased in the free fluorine content to which it decreased in the plasma, or the polymer, or both. anyway, selectivity [as opposed to a high nitride by using the scavenger for fluorines with the etching gas of the hydrocarbon permuted with the fluorine] (10:1 or more [i.e.,]) -- moreover, more oxide etching can be performed to until nitride etching GUNGU so highly that infinity is reached.
[0004]
[Problem(s) to be Solved by the Invention] However, the problem of not being even was further discovered like a slot [like Rhine of polish recon where the nitride was covered] whose nitride front face of the nitride / oxide structure etched at least recently is, or the side attachment wall on a step. Rhine 10 and 12 of the polish recon which was formed on the substrate here and which upheaved where this typical structure is shown in drawing 1 is covered in the profile-layer 20 of a nitride, and the oxide layer 30 and the photoresist mask 40 are formed on it. If an oxide layer 30 is etched until it reaches the

profile-layer 20 through the mask opening 42 of the photoresist mask 40 The nitride 22 on the side attachment wall of Rhine 10 and 12 of the polish recon which upheaved is etched partially at least. An above-mentioned protection polymer such a usual perpendicular front face (perpendicular to the substrate which lies downward generally --) Do not form on the front face which is not in the flat surface same at least as a substrate, or or or a protection polymer Being easily attacked by the etchant gas on a horizontal plane, i.e., the front face which is not evener than the corresponding polymer part formed in the nitride part which is generally between on [10 and 12] an even field (for example, upheaved Rhine) in the substrate which lies downward, is shown.

[0005] Therefore, the substrate including a slot or the eminent side attachment wall of a part which lies downward is expected to offer the etching process of oxide that the nitride front face which is not abbreviation parallel has high selectivity to the nitride which is suitable using it on the front face of the configuration which is etching-proof nature, and which is not even according to an oxide etching process.

[0006]

[Means for Solving the Problem] In the plasma-etching approach for etching oxide, high selectivity is produced from a nitride to one or more hydrogen content gas and the nitride protected by the addition of one or more fluoro hydrocarbon gas regardless of [it is desirable and] the configuration of the nitride part on the front face of a substrate in the scavenger for hydrocarbon etching gas and fluorines which permuted with one or more fluorines. In a suitable example, in order that one or more oxygen support gas may reduce the rate of sedimentation of the polymer on a chamber front face and the front face which should be etched, it is added. Otherwise, deposition of a polymer decreases an etch rate, respectively, and produces deposition of a superfluous polymer on a chamber front face.

[0007]

[Example] This invention includes the addition of one or more hydrogen support gas, and the alternative addition of one or more oxygen support gas in the etchant gas which has hydrocarbon gas permuted with one or more fluorines in contact with the scavenger for fluorines about the plasma-etching approach of the improved oxide of having high selectivity to the nitride suitable for using it in the configuration which is not even. The part of this polymer that these gas forms a polymer on the front face which should be etched, and is formed on a nitride front face is not easily decomposed like the polymer formed in the etching approach stated to the United States patent application numbers 07/941,501.

a. One or more hydrogen support gas added to the etchant gas of the hydrocarbon permuted with the one or more hydrogen support gas fluorine can have hydrogen and/or one or more hydrogen content fluorination carbon. As long as use of hydrogen (H2) is within the limits of this invention, it is desirable that the source of hydrogen which does not burn is used. In a suitable example, one or more hydrogen support gas changes from one or more fluoro hydrocarbons to formula CHX F4-X, however the real target with which x has 1-3. Hydrogen support gas consists of monofluoromethane (CH3 F) substantially most preferably.

[0008] The amount of the hydrogen support gas added to the hydrocarbon etchant gas permuted with one or more fluorines is 1 volume percent (vol. %) of the hydrocarbon etchant gas permuted with one or more fluorines. It is in the range of the numerousness of 100vol(s). %s from the little of extent. The amount of the hydrogen support gas preferably added to the hydrocarbon etchant gas permuted with the fluorine is in the range of about 5vol(s). % to about 100 vol(s). %.

b. In order to control formation of a polymer in an oxygen support vapor etching process One or more oxygen support gas added still more nearly alternatively in gas mixture is independent oxygen (in O2, O3, and form of those mixture), oxygen support gas like CO and CO2, or nitrogen oxides (it NxO(ies)). However, x has mixture with those mixture, oxygen, and/or ozone mutually, or 1-2, and y are 1-2. The amount of these oxygen support gas is in the range of from the small quantity of 1vol.% extent of the hydrocarbon etchant gas permuted with one or more fluorines until [of 300vol(s).% extent] extensive. Preferably, oxygen support gas is in the range of about 50vol(s).% to about 200 vol(s).% of the hydrocarbon etchant gas permuted with the fluorine.

[0009] c. The hydrocarbon etchant gas permuted with one or more fluorines used in the plasma-etching

process of the oxide of hydrocarbon etchant gas this invention permuted with the fluorine is CF4 which generates only carbon ion and fluorine ion, C two F6, and C three F8 excluding hydrogen. Gas and those mixture are included. For example, the amount of the hydrocarbon etchant gas permuted with this fluorine poured by the about 8-10l. etching chamber by the volume is in the range of about 1 (cubic centimeter per minute) to about 100 sccm(s), and is in the range of about 10 to about 40 sccm(s) preferably. however, this rate of flow -- the volume of an etching chamber -- related -- a case -- responding -- namely, a big etching chamber -- receiving -- the upper part -- or he is just going to be understood by that it should be caudad adjusted to a small chamber easily for those who have the usual knowledge of this field

d. The temperature of an etching process and the temperature of a substrate by which pressure parameter etching is carried out are maintained within the limits of about 10-degreeC to about 110-degreeC, and is kept desirable to about 100-degreeC from about 80-degreeC. It is thought that the temperature below about 10-degreeC is too low for actual actuation of an etching process (since a substrate tends to carry out rise heating in an etching process), and, on the other hand, the temperature more than about 110-degreeC has a possibility of damaging the component on a substrate, for example, a photoresist mask.

[0010] The pressure in the etching chamber in a plasma-etching process is the range of an about 0.1mm toll (milliTorr) to an about 100mm toll, and is the range of an about 1mm toll to an about 40mm toll preferably.

e. It is related with the need for an addition of a fluorine scavenger at the process of fluorine scavenger this invention. The exact mechanism over the process of this invention is not understood completely. Moreover, CF4 which generally contains both carbon and a fluorine although there is also no intention to be bound by the special theory of operation, C two F6, and C3 F8 And if the etching gas of a similar carbonization fluorine is put to the plasma A free fluorine atom, CF4, and C two F6 C three F8 The various fragments (fragmentation) containing a radical and a prototype are generated in the plasma. Although used for a fluorine etching the silicon oxide on a substrate, the polymer of the carbon deposited on a substrate, i.e., the oxide on a substrate and the both sides on the front face of a nitride which form a passive state layer, and a fluorine is formed into an etching process. The polymer contains about 60% of the weight of about 30 carbonaceous % of the weight and a carbonaceous fluorine. The polymer currently formed is separated without attacking such a polymer with an oxygen atom, therefore the oxygen atom from an oxide layer barring etching of oxide. However, although silicon oxide will continue etching like [when reaching the layer which does not contain oxygen, i.e., a nitride layer,] if oxygen does not exist, the passivated nitride layer will be etched at a low speed.

[0011] However, we reducing the fluorine content of a passive state polymer, and reducing the amount of the free fluorine in the plasma found out decreasing separation of a passive state polymer. Therefore, if a scavenger for fluorines like the source of a silicon atom or a carbon atom is contacted by the plasma, a silicon atom and a carbon atom combine with a fluorine atom, for example, it is SiFx. It forms, therefore the amount of the free fluorine ion in the plasma is decreased. The polymer deposited on the nitride layer has fewer fluorine atoms, i.e., more carbon atoms, and produces the so-called polymer with "abundant" carbon. There are few carbonaceous abundant polymers than about 40% of the weight of a fluorine, and they are defined as the plasma etchant containing a fluorine as a polymer which is inactive for this process, including 50% of the weight or more of carbon. Therefore, if carbonaceous abundant polymers deposit on a nitride layer, the carbonaceous compound and carbonaceous reaction of abundant polymers will hardly be produced, and, instead, the selectivity of infinity will almost be given to the oxide layer on a nitride. Approach; with various sources of silicon, for example, silicon content gas like a silane (SiH4),; the approach by which diethylsilane (SiH2(C2H4) 2), SiF4, and permuted silane; tera ethyl orthochromatic silicate (henceforth TEOS) like a prototype are added to the plasma can be offered. It decomposes and silicon content gas forms the free silicon which removes the free fluorine atom produced in formation of the abundant carbon-fluorine polymers of the carbon covered on a nitride layer. A nitride layer is not attacked clearly in an etching process, but produces the very high selectivity of the etching process over a nitride.

[0012] Other approaches of forming the abundant carbon-fluorine polymers of such carbon are giving

the source of a front face without the mesh or the hole of the carbon of a solid-state component, or silicon, for example, silicon, in the plasma field to which carbon or silicon acts as other electrodes. It applies on September 8, 1992 and the desirable method of performing this is indicated by the United States patent application numbers 07/941,507 besides Collins transferred to the applicant of this application. In the application, the plasma-etching chamber to which RF power including the free source of silicon was given is indicated, and the free source of silicon is the 3rd electrode which consists of other free sources of silicon in contact with the silicon or the plasma like a silicon liner in for example, a chamber wall. Moreover, the 3rd electrode can be made from graphite as a source of a carbon atom which can remove a fluorine. The temperature of such an auxiliary electrode is kept desirable in the range of about 200-degreeC to about 300-degreeC. United States patent applications 08/138060 of rice others transferred to the applicant of this application in which giving the source of heating silicon separated not only in the side attachment wall of the crystal heated in the etching reactor for promoting formation of the carbon-fluorine polymer needed has the name of "the plasma etching system which has the heated SUKABENJI front face" It is indicated by the number.

[0013] f. plasma etching of the oxide of etching plasma parameter this invention -- the plasma generated in process -- general -- the inside of a plasma chamber -- or the inside of a contiguity chamber -- for example, include all the plasma that can be generated conventionally by giving the grounded electrode and the 2nd electrode connected to RF power source. However, in a suitable example, the plasma used for the plasma-etching process of the oxide of this invention is high density plasma which can be defined as plasma generated as contrasted with the conventional plasma production machine by which capacity coupling was carried out with the plasma production vessel (electromagnetic-coupling plasma production machine) combined in electromagnetism. Such a plasma production machine combined in electromagnetism is indicated by the United States patent application numbers 07/826,310 besides Marks transferred to the applicant of this invention. In order to generate the plasma, the vocabulary a "electromagnetic-coupling plasma production machine" defines all the plasma production machines of the format using electromagnetic fields other than the generation machine combined in capacity, as stated to these United States patent application numbers 07/826,310. Such a plasma production machine combined in electromagnetism is a suitable plasma consistency to be able to generate the plasma which has bigger ion density than about 1010 ion per description ********** as plasma of "high density", and use for the process of this invention.

[0014] In the word "electromagnetic-coupling plasma production machine" For example Vacuum Science Technology B Vol.4, No.4 and Jul/Aug 1986, pp.818-821 Machida "SiO2 Planarization [/ else] Technology With Biasing and Electron Cyclotron Resonance Plasma Deposition for Submicron Interconnections" not only -- The U.S. JP,4,401,054,B specification besides Matsuo, Electronic cyclotron-resonance (ECR) mold plasma production machine which is indicated by the U.S. JP,4,492,620,B specification besides Matsuo, and the U.S. Pat. No. 4,778,561 number specification of Ghanbari () [Electron] Cyclotron Resonance plasma generator It is contained. Moreover, in the word "electromagnetic-coupling plasma production machine", it is Steinberg. Other U.S. JP,4,368,092,B specifications or Flamm The resonator of helical one which was indicated by other U.S. JP,4,918,031,B specifications and which was combined inductively, or a cylindrical shape is contained. Furthermore, in the word "electromagnetic-coupling plasma production machine", it is Boswell. A Helicon diffusion resonator like the plasma production machine indicated by the U.S. Pat. No. 4,810,935 number specification is contained.

[0015] The U.S. JP,4,948,458,B specification of Ogle shows the further format of the electromagnetic-coupling plasma production machine which has the plasma production machine of transformer coupling. Such RF power-source level of the high density plasma responds to the special format of a plasma production machine, the magnitude of a chamber, and the demanded etch rate, and is about 500. Watt to 5kW (kw) It may change. For example, if the electromagnetic-coupling plasma production machine of the ECR mold used in relation to the etch rate demanded for etching about 6l. chamber and about 5000A/is used, power will be in the range of about two to 3 kw typically. If the electromagnetic-coupling plasma production machine of the induction type used in relation to the etch rate demanded for

etching about 2l. chamber and about 5000A/is used, power will be in the range of about one to 2 kw typically. The power level related to the volume of the chamber which will generate power flux density, i.e., the plasma, if it comes out by which the high density plasma should be generated is equal to the power level of about 1000W in a 4l. plasma production chamber. RF bias power is typically impressed to the electrode which grounds a chamber wall, and/or grounds other electrodes, and has the substrate etched. Bias power is adjusted so that hundreds of volts negative direct-current bias may arise on the substrate etched. Typical bias power is 600-1400W to a substrate with a diameter of 200 millimeters, as 100-300-volt direct-current bias is produced.

[0016] g. The suitable etching plant layout drawing 2 shows the etching system suitable for using it in implementation of the plasma-etching approach of the oxide of this invention. A reactor 100 consists of ANODAIZU (it anodized) aluminum or other suitable ingredients, and contains the vacuum chamber housing 110 which has a side attachment wall 120 and the top wall 130, and the pars-basilaris-ossis-occipitalis wall 140, respectively here. The top wall 130 has the central opening 150 between source section of plasma 160A of the upper chamber demarcated by the dome which has top wall 170T of the substrate processing section 160B of a lower chamber, side-attachment-wall 17W of a dome, and the dome which were demarcated between side attachment walls 120-120. Top wall 170T of a dome can be constituted like the cap of the single or double wall which was formed with a dielectric like Xtal and which was made reverse. The degree of vacuum inside the chamber housing 110 (chamber 160) was controlled by the throttle valve 180 of vacuum Rhine 190 inserted in the pars-basilaris-ossis-occipitalis wall 140, and is connected to the vacuum pump equipment which has one or more vacuum pumps. Process gas is supplied to a chamber 110 with G1 and G2 which have been arranged, respectively the perimeter side of the top 170T and the substrate which should be etched of the base of source field of plasma 160A, and a dome, and the three manifold insertion sources of G3. The whole gas stream meets the other path 34 from source field of plasma 160A of a chamber at the substrate 5, and meets the path 36 from the substrate 5 to the outlet manifold 330, and meets the path 37 from the outlet manifold 330 to vacuum devices 210.

[0017] With the source to which power was supplied with RF power source and the matching circuit network 310 and which has the antenna 300 of 1 turn or a coil at least, RF energy approaches side-attachment-wall 17W of a dome, and is supplied to a dome. An antenna 300 is rolled so that it may resonate for efficient inductive coupling with the source of the plasma, or it resonates using a distribution component, for example, capacity. It is concentrated on the volume by which it was demarcated in the coil antenna 300, and the plasma is generated in a dome. The active species containing ion, an electron, a free radical, and the excited neutral moves by diffusion toward the substrate 5 which should be etched by the big flow for the gas stream generated by the gas manifold equipments G1 and G2 and G3 again. The bias energy input unit 410 which has a power source 420 and the bias matching circuit network 430 increases alternatively the plasma sheath electrical potential difference in a substrate for RF energy, therefore combines the ion energy in a substrate with the substrate support electrode 32 for increasing alternatively. In the illustrated example, the chamber builds in three original arrangements of electrode which give the fluorine scavenger relevant to the plasma described further here. SAKURIFI by which the substrate support electrode 320 has one cathode, and the chamber side attachment wall 120 has an anode, and the 3rd electrode was put on the bottom of dome top plate 170T -- it has sial electrode 17S. Although this 3rd electrode can also float, it is desirable to be made from silicon, a silicon content alloy, or carbon like graphite with desirable and it being grounded or connecting with the RF power source 400.

[0018] Act, and superfluous fluorine ion is in mutual [this / 3rd electrode and mutual], and responds to a case case. SiFX CFX It makes and this decreases the total of the fluorine ion in the plasma. The following example will be useful to the various examples of this invention being shown.

It is a substrate with an example I diameter of 150 millimeters, this substrate is under a photoresist mask and a mask with a thickness of about 5,000-10,000A, and it is PECVD. Having the layer of the silicon oxide which has covered the deposited silicon nitride layer, silicon wafer ** is carried out and this silicon nitride layer forms the same structure as the thing which has covered the step on a silicon wafer

and which was shown in drawing 1 . This substrate was etched within available RF etching chamber commercially from Applied Materials as a SENCHURA HDP dielectric etching system (CenturaTM HDP Dielectric Etch System), as mentioned above about drawing 2 . The 3rd grounded electrode which consists of silicon and is maintained in the etching chamber at the temperature of about 260-degreeC was used as a source of silicon which constitutes a fluorine scavenger. C three F8 20sccm(s) were passed in the chamber as hydrocarbon etching gas permuted with the fluorine together with 3sccm(s) of CH3 F as hydrogen support gas. The pressure in an etching chamber was maintained at the about 3mm toll between etching, and the temperature of a substrate was maintained at about 100-degreeC. Plasma production power level was kept at about 200W. The direct-current bias voltage of 200 volts of minus was maintained on the substrate between etching by adjusting RF bias power to 650W. Etching was performed through opening of a mask for about 2 minutes, and the nitride layer under etched opening which is in an oxide layer through a resist mask by that cause was exposed.

[0029] The layer of the each oxide and the nitride containing the part of the nitride layer on the side attachment wall of a step was inspected by SEM, and it turned out that the selectivity of this invention to the ratio of the etched oxide and a nitride, i.e., the nitride of a flat field, is abbreviation infinity:1. On the other hand, it turned out that the selectivity of the nitride pair oxide on the side attachment wall of a step is about 15:1.

In order to show the process of Example I of having added oxygen support gas to the etching process of example II this invention, 30sccm(s) of CO gas are C two F6. It was repeated on the substrate with which the treatment of Example I was similarly covered except for what was passed by the chamber with the hydrocarbon etching gas and the hydrogen support gas of CH3 F which were permuted with the fluorine. Etching was again performed for about 2 minutes. Each layer was again inspected by SEM as in Example I. It turned out that the selectivity of the ratio of the etched oxide and the etched nitride, i.e., the etching process of this invention over a nitride, is abbreviation infinity:1 again in a flat field, and is 12:1 or more on the side attachment wall of a nitride. The substrate processed according to Example II was again inspected by SEM, in order to know whether there is any etching residue or polymer deposit on a substrate further. And such an ingredient was not found out even if it was after processing of 200 or more substrates within the etching chamber.

[0030]

[Effect of the Invention] Therefore, the approach of this invention offers the high selectivity over a nitride unrelated to the location of a nitride layer about the field of the substrate which is downward to plasma etching of an oxide layer by adding oxygen support gas to the etching gas of the hydrocarbon permuted with the fluorine used with regards to the fluorine scavenger under the existence of a nitride. Furthermore, by adding oxygen support gas to mixed gas into an etching process, an etch rate can be increased and the deposit of a chamber wall can be decreased.

[Translation done.]

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] the approach of carrying out plasma etching of the oxide to the bottom of existence of the nitride which shows high selectivity to a nitride including a nitride on the front face which is not flat -- it is -- the bottom of existence of a fluorine scavenger -- setting -- a -- the etching gas of the hydrocarbon permuted with one or more fluorines, and b -- the oxide which contacts the mixed gas which has one or more hydrogen support gas in said oxide -- the plasma-etching approach.
[Claim 2] The total amount of said one or more hydrogen support gas is an approach according to claim 1 in the range of about 1vol.% to about 100 vol(s).% of the etching gas of the hydrocarbon permuted with said one or more fluorines.
[Claim 3] It is the approach according to claim 2 the etching gas of the hydrocarbon permuted with said one or more fluorines has Formula CXF (2X+2), and x has 1-3.
[Claim 4] For 1-3y, x is [1 to 2x+1 and z] one or more fluoro hydrocarbons with which said one or more hydrogen support gas has hydrogen and Formula CxHyFz and such two or more mixture, however an approach according to claim 2 chosen from the group who consists of 2x+2-y.
[Claim 5] Said one or more hydrogen support gas is monofluoromethane (CH3F) and difluoromethane (CH two F2), Approach according to claim 2 chosen from the group who consists of trifluoromethanes (CHF3) and such two or more mixture.
[Claim 6] said one or more hydrogen support gas -- substantial -- monofluoromethane (CH3 F) from -- approach according to claim 2 which changes.
[Claim 7] Said mixed gas is an approach containing one or more oxygen support gas of the amount in the range of about 1vol.% to about 300 vol(s).% of the etching gas of the hydrocarbon further permuted with said one or more fluorines according to claim 2.
[Claim 8] Said one or more oxygen support gas is oxygen (O2), Ozone (O3), a carbon monoxide (CO), and carbon dioxide (CO2), Approach according to claim 7 chosen from the group who consists of nitrogen oxides (1-2y are 1-2 for NxOy, however x), and such two or more mixture.
[Claim 9] Said one or more oxygen support gas is an approach according to claim 7 chosen from the group who consists of a carbon monoxide, carbon dioxides, and such mixture.
[Claim 10] Said fluorine scavenger is an approach according to claim 2 chosen from the group who consists of silicon and carbon.
[Claim 11] Said fluorine scavenger is the approach according to claim 10 of being the silicon front face distant from said oxide and said nitride.
[Claim 12] The fluorine scavenger on said front face of silicon is an approach according to claim 11 electrically connected with said plasma.
[Claim 13] The fluorine scavenger on said front face of silicon is an approach according to claim 11 grounded.
[Claim 14] The fluorine scavenger on said front face of silicon is an approach according to claim 11 currently maintained at the temperature of about 200-degreeC to 280-degreeC within the limits.
[Claim 15] It is the plasma-etching approach of oxide which it has a nitride side attachment wall in the

integrated-circuit structure on a substrate, and shows high selectivity to a nitride. a) The substrate which has an oxide layer and a nitride layer is loaded to an etching chamber. b) i Formula CXF (2X+2), however etching gas of the hydrocarbon permuted with one or more fluorines with which x has 1-3, ii) Formula CxHyFz, however x 1 to 2x+1, and z for 1-3y 2x+2-y, One or more hydrogen support gas which consists of the fluoro hydrocarbon which **** substantially, And iii The plasma is generated for one or more alternative oxygen support gas in a sink and the c aforementioned chamber, and said plasma is contacted in d fluorine scavenger. By that cause The plasma-etching approach of the oxide characterized by etching said oxide layer while maintaining high selectivity to a nitride.

[Claim 16] The total amount of said one or more hydrogen support gas which flows to said chamber is an approach according to claim 15 in the range from about 1vol.% to about 100vol(s).% of the etching gas of the hydrocarbon permuted with said one or more fluorines.

[Claim 17] The total amount of said one or more hydrogen support gas which flows to said chamber is an approach according to claim 15 in the range from about 1vol.% to about 100vol(s).% of the etching gas of the hydrocarbon permuted with said one or more fluorines.

[Claim 18] The total amount of said one or more oxygen support gas which flows to said chamber is an approach according to claim 15 in the range from about 0vol.% to about 300vol(s).% of the etching gas of the hydrocarbon permuted with said one or more fluorines.

[Claim 19] Said fluorine scavenger in contact with said plasma is a method according to claim 15 of having silicon.

[Claim 20] Said fluorine scavenger is a method according to claim 15 of having solid-state silicon in contact with said plasma.

[Claim 21] Fluorine KABENJA of said solid-state silicon is an approach according to claim 20 grounded electrically.

[Claim 22] Said fluorine scavenger is a method according to claim 19 of having silicon containing the gas in contact with said plasma.

[Claim 23] In the bottom of existence of the fluorine scavenger which has the silicon electrode which is the approach of carrying out plasma etching of the oxide under existence of the nitride which shows high selectivity to a nitride including a nitride on the front face which is not flat, and was grounded electrically a) -- the etching gas of the hydrocarbon permuted with one or more fluorines, and b -- one or more hydrogen support gas and c -- the approach of contacting alternatively the mixed gas which has one or more oxygen support gas in said oxide.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The fragmentary vertical cross section of the typical structure which has the configuration with the nitride part which is a perpendicular generally which is not flat in the oxide part which should be etched, and the substrate which is downward, and should be etched by the approach of this invention at it.
[Drawing 2] The sectional view of a suitable etching system suitable for using it by the approach of this invention.

[Translation done.]

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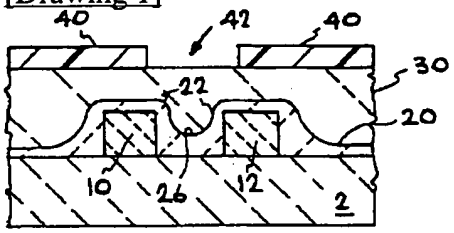
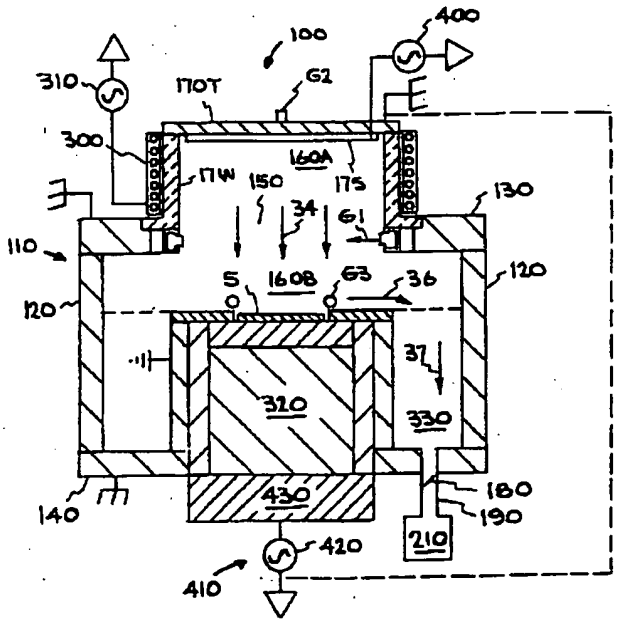
DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]